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ON THE RELATIONSHIP BETWEEN THE E_s-LAYER AND THE VARIATIONS OF THE MAGNETIC FIELD

by
O. Ovezgel'dyyev
[USSR]

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ON THE RELATIONSHIP BETWEEN THE E_s - LAYER AND THE VARIATIONS OF THE MAGNETIC FIELD *

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SUMMARY

It is shown in this paper that there is no relationship between the E_s-layer and the irregular variations of the magnetic field components. As such this paper is a continuation of a previous work, where the relationship of the E_s - layer of the ionosphere with the daily variations of the geomagnetic field have been studied. The conclusions of the present paper are based upon the data of the Ashkhabad ionospheric station and magnetic observatory for summer periods of 1960, 1961 and 1962.

* * *

It is well known that the quiet solar-daily variation of the magnetic field varies substantially from day to day, although the its daily periodicity is perceptible evey day. Naturally, the cause of such irregular variations must, first of all, be searched for in processes responsible for the quiet solar-daily variation of the magnetic field.

The influence of local conductivity increase on the variations of the magnetic field has been recently considered in a series of works [1-3]. In the work [3], the variation of the magnetic field on the earth's surface, occurring at local increase of conductivity in the E-region of the ionosphere, was computed on the basis of Maxwellian equations for a quasistationary case. However, the role of the electrical polarization field, which is an inalienable element of the local conductivity increase, has not been taken into account.

The process of local current density increase on account of local conductivity increase, taking into account the polarization, was the object

* O SVYAZI E_s S VARIATSIYAMI MAGNITNOGO POLYA

of a more detailed consideration in the work [4] by Martyn. Applying the latter author's method, K. G. Ivanov [2] computed the variations of the geomagnetic field on the earth's surface, caused by local conductivity increase in the E-region. It should be noted that the assumption of electrodynamic stability, that is, of the absence of charge accumulation at the boundary of local conductivity increase with the surrounding medium, made in the works [2] and [4] for the calculation of local current density increase, leads to hydrodynamic instability of the region of increased conductivity. The question to what extent this assumption is correct so far remains open. Fejer [5] shows, in particular, that such a hydrodynamic instability in the ionosphere must not take place.

When investigating the irregular variation of the magnetic field, it appears to be of interest to study its link with the processes taking place in the E-region, where the current system responsible for the quiet solar-daily variation is located. In the work [6] we considered the link of the sporadic E-layer of the ionosphere with the daily variations of the Earth's magnetic field. In the present work we bring up the results of subsequent analyses based upon the data from the Akhshabad ionospheric station and the magnetic observatory for May - August 1962, August 1961 and June 1960.

The data processing amounted to the following. For every month we selected the days with values $f_oE_s > 7$ Mc, $f_bE_s > 5$ Mc and when the E_s-layer existed for more than two hours. For the remaining days of the month, except for magneto-disturbed days, we plotted daily averages of the course of f_oE_s and of the magnetic field components (H, Z, D). Then, for every sorted day of the month and for every parameter, graphs of the difference between individual and mean-daily values were plotted; we shall denote them separately as irregular variations of f_oE_s, H, Z, D. Such graphs for the first of July 1962 are shown in Fig. 1. Subsequently we computed the correlation factor of the irregular variation of f_oE_s with the irregular variations of the magnetic field components. The correlation factor was computed by the formula

$$\rho_{xy} = (\overline{xy} - \overline{yx}) / \sigma_x\sigma_y,$$

where x, y are parameters, between which there is relationship; σ_x and σ_y are respectively their RMS deflections.

42 such selected days were subject to analysis. Presented in Fig. 2 are the histograms of the correlation factor distribution of f_oE_s irregular

variations with the irregular variations of the D-, Z- and H-components of the magnetic field. It should be noted that in the given case the limit of correlation factor variations on account of the limitedness of the selection's volume, estimated by the method of reference [7], is equal to $\pm$ 0.5. Consequently, if the irregular variations of $f_o E_s$ are linked with the irregular variations of the magnetic field components, the absolute value of the correlation factor must be greater than this quantity. In reality, f_oE_s, H, f_oE_s, Z, f_oE_s, D, exceed 0.5 only in respectively 19, 17 and 10 percent of cases, and even in these cases the values of the correlation factor are more often $\leqslant 0.6$.

Thus, it follows from the above that the link between E_s and the irregular variations of the magnetic field components is absent.

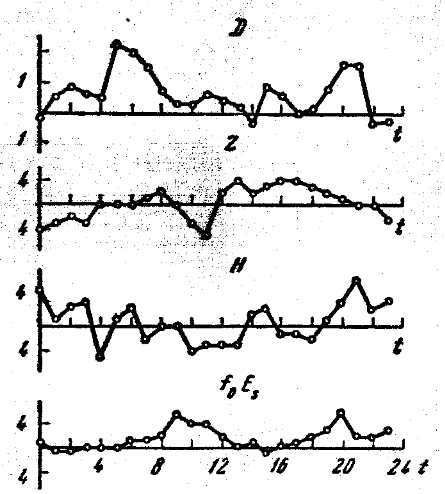

Fig. 1

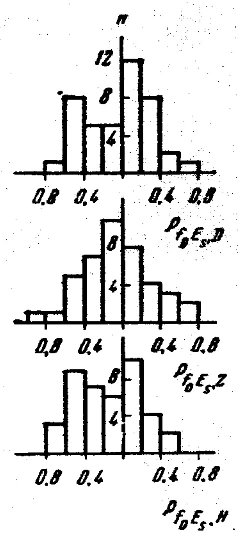

Fig. 2

The certain asymmetry in the distribution of the correlation factors may be explained by the fact that the sign of irregular variation of E_s is positive most of the time of a day (for conditionally we selected the days when E_s was present with a very great $f_o E_s$), whereas the sign of the irregular variations of the magnetic field components varies continuously.

In conclusions I express my gratitude to G. V. Mikhaylova for her help in computations.

THE END

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Geophysics and Seismology Branch
TurkmSSR Academy of Sciences

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